

Fig. 10. Filament bearing an older sporange.

Fig. 11. Spore detached and quite ripe. It is still surmounted by a heterocyst. The transparency allows the enclosed spore to be distinguished.

Fig. 12. Germination.

Fig. 13. A young filament produced by germination of the spores.

II.—*On some new Trilobites from Canadian Rocks**. By E. J. CHAPMAN, Professor of Mineralogy and Geology, University College, Toronto.

I. *On a new species of Asaphus from the Silurian Rocks of Upper Canada.*

§ 1. *Introductory Notice.*—In the autumn of 1856, I communicated to the ‘Canadian Journal,’ under the title of *Asaphus Canadensis*, a brief notice of a supposed new Trilobite from the Utica schist (Lower Silurian) of Whitby, in Canada West; and in a subsequent number of that publication, I gave a more detailed description of the form. At the same time I pointed out that Professor Hall of Albany believed it to be identical with a species founded by him (under the name of *Asaphus* (?) *latimarginatus*) on two imperfect caudal shields, figured in the first volume of his ‘Palæontology of New York.’ At the period in question, I was not in a position, from the want of works of reference and other sources of information, to claim this Trilobite as actually new; but an extended investigation having shown it to be really a distinct form,—a view also adopted by others,—I now publish a complete description of the species, together with as accurate a figure as I am able to get executed in Canada (see p. 13). In this communication, also, I have attempted to show, by a brief analysis of all the fairly-established species of the genus *Asaphus*, that our Canadian species is undoubtedly distinct. I should state, with regard to the figures of Professor Hall, alluded to above, that it is impossible to determine whether our species be identical or not with these. In the words of Barrande, in his great work on the Silurian Basin of Bohemia, they are too incomplete to be determined with any certainty†. For this reason, in the Museum of the Geological Survey of Canada, the specific name of *Canadensis*, as originally bestowed on this Trilobite by the author, has been retained. Barrande, in the work just cited, alludes to another American Trilobite in

* Communicated by the Author.

† “Divers fragments d’Amérique nommés *Asaphus* par J. Hall, et figurés dans la Paléontologie de New York, sont trop incomplets pour être sûrement déterminés.”—Barrande, *Système Silurien du Centre de la Bohême*, vol. i. p. 657.

the possession of M. de Verneuil, but unnamed and unfigured, with which our species may very possibly agree; only the caudal shield of this specimen would appear to possess no lateral segmentation, and to have scarcely a defined axis, as M. Barrande refers it to the *platycephalus* or *gigas* type*. His statement respecting it is as follows:—"Nous avons vu récemment, dans la belle collection de notre ami M. de Verneuil, un *Asaphus* des États-Unis, qui, portant à l'angle géral une pointe longue et grêle, constitue une espèce très distincte d'*As. (Is.) gigas*. Malheureusement, nous ne savons quel est le nom spécifique qui lui a été donné par les savans Américains. Ce Trilobite se rangerait dans le groupe de *A. gigas*, d'après les souvenirs qui nous restent de sa conformation."

§ 2. *Description of Asaphus Canadensis*.—This description is based on what is probably the long or male form.

General outline a broad oval. Vertical to transverse diameter nearly as 3 : 2. Relative lengths of head-shield, thorax, and pygidium, as 1 : 0·88 : 1·1.

Head-shield obtusely pointed anteriorly, much as in *Asaphus platycephalus*. Genal angles terminating in sharply-pointed horns of the *paradoxides* type, extending downwards to about the middle of the body †. Facial suture as shown in the figure; the branches uniting in an obtuse but clearly defined angle above the glabella, nearly at the extreme anterior margin of the head-shield, and terminating at the lower margin, about midway between the glabella and the genal angles. Glabella feebly raised, broad, and generally conformable at its upper part to the outline of the facial suture. At its base there occurs a slight but evident neck-furrow. There are no furrows on the glabella itself. Length of glabella to length of head-shield as 0·8 : 1·0. Eyes moderately raised and delicately reticulated, although in most specimens they are more or less destroyed. Breadth between the eyes, to extreme breadth of head-shield across them, as 5 : 11. Whole surface of the head-shield covered with fine punctures, except at the striated limb.

Thorax with eight segments. Axis well defined; narrow, somewhat broader in the middle than at the ends. Mean breadth of axis to breadth of each side-lobe, as 5 : 6. Pleuræ terminating in slight points, and curving slightly downwards ‡; fur-

* It is perhaps the *Asaphus Iowensis* of Dale Owen.

† In most specimens, as in the figure, the horns extend to the bottom of the fourth thoracic segment; but in a small specimen obtained quite recently from Whitby, and kindly submitted to us by Mr. J. F. Smith of Toronto, they reach to about the middle of the sixth pair of pleuræ.

‡ In the horned *Asaphidæ*, and in nearly all the horned Trilobites, the pleuræ point downwards; whilst in the forms with rounded genal angles,

rowed to about half their length from the axis, and then crossed obliquely by a curvilinear ridge. A second, but slighter, furrow runs along the lower edge; and two short deep furrows, shaped together like the letter V placed upon its side with the point inwards, separate each pleura from its axis-segment. Beyond the ridge the points are delicately striated. Fine punctures occur upon the axis and also on the pleuræ. On the latter the punctures are larger and farther apart; and, when examined through a magnifying glass, they appear to be of a semilunar form, with the convex side turned inwards; they are likewise more deeply indented at the convex side.

Pygidium oval, with striated limb and well-developed tapering axis. This terminates somewhat abruptly before reaching the end of the pygidium. It contains from 12 to 14 segment-markings, and a similar number are present on the side-lobes. All are destitute of secondary furrows. Those on the side-lobes bend downwards near their extremities, and merge into the striated limb. The lower ones are nearly vertical. The whole surface of the pygidium is covered with fine punctures, shaped and arranged exactly like the punctures on the surface of the thorax. *Asaphus platycephalus*, as mentioned by Professor Hall, exhibits in some specimens a delicately punctured surface; but in the present species the punctures appear to be much more striking. Our other new species, *A. Halli*, is also very visibly punctured, although the punctures, as shown in our figures, are too coarse and too far apart.

The only specimens of *Asaphus Canadensis* hitherto obtained, have been procured from the Utica schist (Lower Silurian) of the townships of Whitby and Nottawasaga (localities about 80 miles apart), in Canada West. They occur in association with *Triarthrus Beckii*. In length they appear to vary from about an inch and a half (= 38.1 millimetres) to about 5 inches (= 127 millimetres). I have not yet been able to observe the under side, so as to make out the direction of the under sutures and the form of the hypostoma. An isolated hypostoma, however, found near Whitby, probably belongs to this species. It is badly preserved, but it appears to resemble very closely the hypostoma of *A. platycephalus*.

§ 3. *Specific differences*.—(1.) *Asaphus Canadensis* differs from *A. platycephalus*, Stokes (*Isotelus gigas*, DeKay); *A. expansus*, Linn.; *A. Barrandei*, De Verneuil; *A. læviceps*, Dalman; *A.*

the pleuræ have almost invariably an upward curve, as in the figure of *A. Halli*, on page 13. When the side-pieces or checks of the head-shield are broken off, we may generally determine the nature of the genal angles by this character.

(*Is.*) *affinis*, M'Coy (including *Is. gigas*, *Is. planus*, and *Is. Powisii* of Portlock)—in having, with other opposing characters, the genal angles of the head-shield extended into horns.

(2.) It differs from *A. tyrannus*, Murchison, *A. Powisii*, Murchison, and *A. ingens*, Barrande—in having, with other opposing characters, the branches of the facial suture united above the glabella on the upper surface of the head-shield.

(3.) It differs from *A. nobilis*, Barrande, in wanting the curved furrows on the axis of the pygidium, as exhibited by that species; and also by the greater number of the segment-markings on the side-lobes of its pygidium, as well as by the general outline of the facial suture, and other characters.

(4.) It differs from *A. extenuatus*, Waldheim, by the obtuse outline of its cephalic shield, and by other marked characters.

(5.) It differs from *A. (Is.) laticostatus*, Green,—the genal angles of which are unknown,—by its thorax being nearly of the same length as its head-shield, and by the greater number of segment-markings on the side-lobes of its pygidium, as well as by other characters.

(6.) It differs from *A. ovatus*, Portlock, by the presence of segment-markings on the side-lobes of its pygidium. I am not acquainted with the head-shield of *A. ovatus*, and I cannot here obtain a copy of Colonel Portlock's Report in which the species is figured.

(7.) It differs from *A. angustifrons*, Dalman, and *A. frontalis*, Dalm., by the greater development of its genal points; Dalman's species being placed by him under his subdivision "*Mutici*," comprising the forms with rounded or but slightly pointed genal angles. I am not sufficiently acquainted, however, with these Swedish species to name any other distinguishing characters; and I have no means of procuring here a copy of Dalman's 'Palæaden,' in which the species are described.

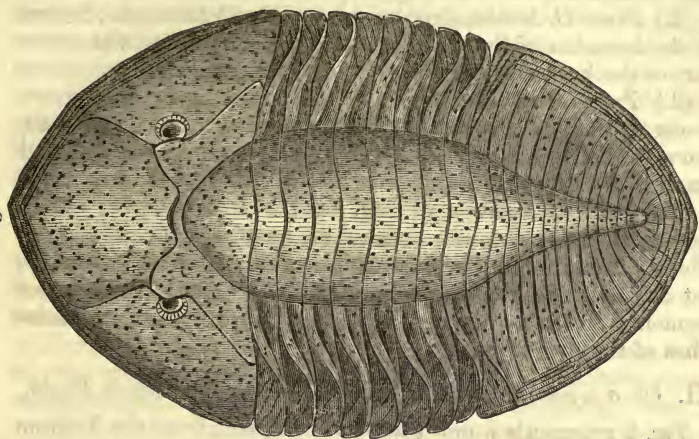
(8.) It differs from *A. Iowensis*, Dale Owen, by its genal points reaching only to the middle instead of to the end of the thorax; by its facial suture being pointed, instead of curved, above the glabella; and by the presence of segment-markings on its pygidium.

The head-shields of *A. grandis*, Sars, *A. Fournetti*, De Verneuil, and *A. latimarginatus*, Hall, are still unknown.

(9.) It differs from *A. Cianus*, Barr. (the genal angles of which are unknown), by its slightly raised glabella and by its narrow body-axis.

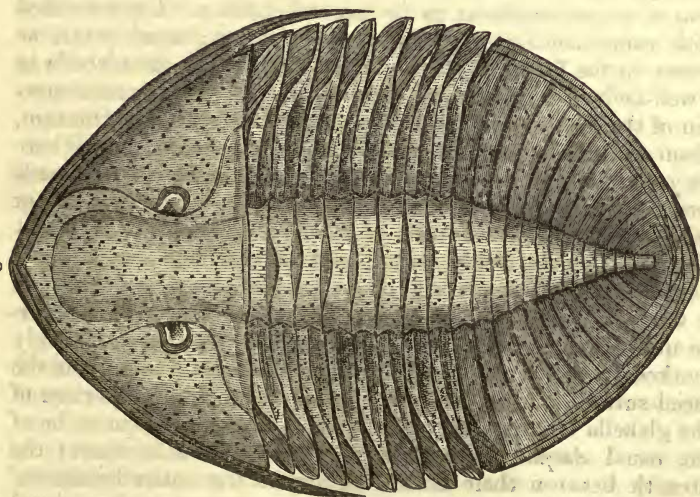
(10.) It differs from the imperfectly-known *A. glabratus* and *A. contractus* of Barrande, by its feebly raised glabella, by the greater number of segment-markings on the side-lobes of its pygidium, and probably also by the direction of its facial suture.

Fig. 2.



Asaphus Halli (E. J. Chapman, sp. 1858).

Fig. 1.



Asaphus Canadensis (E. J. Chapman, sp. 1856).

Finally, apart from the absence of secondary furrows on the pygidium-segments, *Asaphus Canadensis* differs from the generally admitted species of *Ogygia* by the following characters:—

(1.) From *O. Buchii*, Brongniart, and *O. (?) Portlockii*, Salter, by the branches of the facial suture being united on the upper part of the head-shield.

(2.) From *O. (?) Guettardi*, Brongniart; *O. (?) Desmaresti*, Brong.; *O. (?) Brongniarti*, Rouault; and *O. (?) Edwardsi*, Rouault—by the angular junction of the branches of its facial suture above the glabella.

(3.) From *O. radians*, M'Coy, by the large number of the segment-markings on the axis of its pygidium, *O. radians* exhibiting only three. The head-shield of *O. radians* is unknown; but M'Coy refers the species to *Ogygia*, on account of the short segmental furrows between the larger markings on the side-lobes of the pygidium.

II. On a second new species of *Asaphus* from Canadian Rocks.

Fig. 2 represents a new species of *Asaphus*, from the Trenton limestone (Lower Silurian) of Peterborough and other localities in Upper Canada. The same form is believed to occur also in the Utica schist.

General outline a broad oval; length to breadth as 3 : 2, or thereabouts; relative lengths of head-shield, thorax, and pygidium, as 1 : 0·87 : 0·87.

Head-shield obtusely pointed anteriorly, and much resembling that of *A. platycephalus* in its general outline. Limb striated with concentric lines; genal angles rounded; facial suture as shown in the figure. The branches unite above the glabella in a well-defined angle, almost touching the extreme anterior margin of the head-shield; and they terminate at the lower margin, about midway between the glabella and the genal angles. Where they join this lower margin, they make a short curve inwards (see the figure), somewhat as in *A. expansus*,—a peculiarity not exhibited by the facial sutures of *A. platycephalus* (?) or *A. Canadensis*. Glabella feebly raised, and divided into two distinct portions; the lower portion, of a semi-oval shape, is defined, as it were, by a prolongation of the body-axis. Directly above this an undulating furrow occurs (as shown in the figure), strongly marked in the centre, but becoming fainter where it joins the facial suture, a little above the eyes. The anterior portion of the glabella is altogether undefined. The eyes appear to be of the usual *Asaphus* type; they are somewhat wide apart; the breadth between their central points, to the entire breadth of the head-shield across them, is as 5 : 9. Except at the striated limb, the whole surface of the head-shield is finely punctured.

Thorax with eight segments; division-line between the axis of each segment and its pleuræ not very sharply defined. There are no intermediate V-shaped furrows, as in *A. Canadensis*. The pleuræ curve upwards at their slightly rounded extremities; they are furrowed to about half their length from the axis, and then crossed by a curvilinear ridge, beyond which the upper portions are delicately striated. The axis and the side-lobes (in the transverse measurement of the Trilobite) are of equal breadth. The middle segments of the axis are slightly broader than the upper and lower segments. The surface is very delicately punctured. The pygidium closely resembles that of *A. Canadensis*. In the axis there are from twelve to fourteen segment-markings, with a similar number on each side-lobe. There are no secondary furrows. The striæ on the limb are largely developed. Hypostoma, &c., unknown.

The two nearly perfect specimens and the various fragments of this species that I have examined, belong to individuals of comparatively large size. Of the perfect specimens, one is nearly 5 inches in length (= 127 millimetres), and the other exactly 6 inches (= 152·4 mill.).

Specific differences.—*Asaphus Halli*, on account of its rounded genal angles, need only be compared with the following species: *A. platycephalus*, Stokes (*Is. gigas*, Dekay, &c.); *A. expansus*, Linn.; *A. leviceps*, Dalman; *A. Barrandei*, De Verneuil; and *A. (Is.) affinis*, M'Coy, the latter species being made to include Portlock's *Is. gigas*, *Is. planus*, and *Is. Powisii*. All the other well-recognized species of *Asaphus* are horned forms.

The new species differs from *A. platycephalus* more especially by its divided glabella, and by the presence of furrows on its pygidium.

It differs from *A. expansus* and *A. leviceps* by the form of the glabella, the angular junction of the branches of the facial suture, and the segment-markings on the side-lobes of the pygidium. The latter character distinguishes it also from *A. affinis*.

It differs from *A. laticostatus*, Green,—of which species the genal angles are unknown,—by its thorax and pygidium being of equal or nearly equal length, and by its divided glabella.

M. de Verneuil's species, *A. Barrandei*, from the south of France, is only known to me by name. Reasoning from analogy, however, it may be fairly admitted that the two species are distinct.

Our new Canadian species somewhat approaches Barrande's *Asaphus nobilis*, by the curious transverse furrow on its glabella. In *A. nobilis*, however, the genal points of the head-shield terminate in horns, and the segments of the thoracic and caudal

axis are marked by peculiar furrows,—characters not exhibited by the present species. The transverse furrow on the head-shield probably corresponds more or less in outline with the underlying hypostoma; but no traces of the latter organ, as already remarked, have yet been found.

In the preceding article on *Asaphus Canadensis*, it was stated that Professor Hall had published, in the first volume of the 'Palæontology of New York,' two imperfect caudal shields, under the name of *Asaphus* (?) *latimarginatus*. I would willingly adopt this specific name for our second Canadian form, because, so far as it is possible to determine, the two may prove eventually to be alike; but, on due consideration, I have thought it advisable to bestow upon the form in question a name altogether distinct. My object in this is solely to avoid the chance of confusion, in case the thorax and head-shield of Professor Hall's form should hereafter be discovered, and be found on examination, as would very likely happen, to constitute a different species. I therefore claim the privilege of naming the Trilobite described in this article,—a privilege to which I am justly entitled by the really indefinite character of the figures referred to above. The name I adopt as the most appropriate, under the circumstances of the case, is that of *Asaphus Halli*. Palæontologists, I am sure, will receive it willingly.

III.—On the Structure of *Humphreyia*, an anomalous Bivalve Shell, hitherto confounded with *Aspergillum*. By Dr. J. E. GRAY, F.R.S., V.P.Z.S. &c.

In the preceding Number of this Journal, I gave an account of the development of the genus *Aspergillum*. Shortly after it was in print, Mr. Cuming kindly allowed me to examine the specimens of that genus in his extensive collections. I was delighted to find, mixed with the other species, a shell, which I was convinced, on a very cursory glance, could not be formed in the same manner as the *Aspergilla*, and, indeed, could have but very little relation to the other species of the genus to which it has been referred by Mr. Arthur Adams, who described and figured it in the 'Proceedings of the Zoological Society' for 1852 (p. 91. t. 15. f. 3), under the name of *Aspergillum Strangei*. It was received from Sydney Bay, Australia, by the late Mr. Strange.

This animal, instead of living in a tube sunk in the sand or mud of the sea-coast, like the *Aspergilla*, or in a tube more or less immersed in the substance of shells, rocks, or other marine bodies, like the *Gastrochænæ* and *Clavagellæ*, fixes itself by its ventral surface to shells or rocks, so that the whole of the